

British Columbia Drought Response Plan



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Prepared for the Ministry of Environment
on behalf of the Inter-Agency Drought Working Group

Prepared by:

econnics
eco-efficiency specialists

econnics - eco-efficiency specialists
www.econnics.com
kirk@econnics.com
+1 250 588 6851

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Legal Disclaimer

This plan does not address emergency response measures as defined in the *Emergency Program Act* (1996). The declaration of any drought level or condition and subsequent response does not imply municipal or provincial compensation for economic loss.

The information provided in this plan is offered as a public service. Many factors may influence water supply availability including, but not limited to, precipitation, topography, geography, the existence of microclimates, storage capacity, and population demands. As a result, the information in this plan is necessarily general in nature and should not be relied upon as specific advice for responding to particular circumstances. You will have to review your particular circumstances and then determine whether the suggestions in this plan are appropriate to those circumstances.

Water suppliers, local governments, improvement districts, other authorities, and water licensees should consider the appropriateness of the suggestions in this plan and adapt them to suit their specific local conditions and requirements. Plans and bylaws should not be put in place by water suppliers or users without first receiving appropriate professional and legal advice.

While information provided within this plan is believed to be accurate at the time of publication, we cannot confirm its currency, accuracy, or completeness or its applicability to or suitability for individual circumstances. Therefore, persons using this plan should take steps to independently verify the information.

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Acronyms Used In This Document

ADM CILM	Assistant Deputy Minister’s Committee on Integrated Land Management
DFO	Fisheries and Oceans Canada
IADWG	Inter-Agency Drought Working Group
MAL	British Columbia Ministry of Agriculture and Lands
MCRD	British Columbia Ministry of Community and Rural Development
MoE	British Columbia Ministry of Environment
MFR	British Columbia Ministry of Forests and Range
MHLS	British Columbia Ministry of Healthy Living and Sport
PAB	British Columbia Public Affairs Bureau
EMBC	Emergency Management B.C., Provincial Emergency Program, British Columbia Ministry of Public Safety and Solicitor General
TDWG	Technical Drought Working Group

1. Overview

1.1. *What is Drought?*

Drought is a recurrent feature of climate involving a deficiency of precipitation over an extended period of time, resulting in a water shortage for activities, communities or aquatic ecosystems.¹ In British Columbia, drought may be caused by combinations of insufficient snow accumulation, hot and dry weather or a delay in rainfall.

Drought conditions can impact communities and individuals in many different ways. Drought can lead to reduced water availability for household and business use. Lower streamflows may cause warmer river temperatures, which impacts fish and other aquatic life. It can also affect the growth of agricultural crops and limit the water available for irrigation. Low streamflows can also have impacts on groundwater levels. Aquifers can be impacted in a given drought year and following previous drought seasons, as there may not be enough water to allow for recharging. If natural water sources or adequate storage is not available in a community, it may also lead to insufficient supplies for fire fighting. Drought season in British Columbia also coincides with summer tourism and associated increased demand for water. Reduced water availability during the summer can have significant economic impacts where communities rely on the summer tourism industry.

Droughts can be defined as meteorological, hydrological, agricultural or socioeconomic, each of which implies different impacts. Definitions of these different types of drought, developed in conjunction with other western and northern provinces and territories through the Western Water Stewardship Council, can be found in Appendix 2.

Being prepared to respond to droughts when they occur will help communities protect water for drinking, sanitation and fire protection. It will help protect fish and aquatic ecosystems. It will aid the Ministry of Forest and Range (MFR) in responding to wildfires. It will also improve the chances of sustaining agricultural and other economic activity during dry periods.

1.2. *About This Plan*

This plan focuses on drought *response* - the actions taken preceding, during and immediately following a drought to reduce its impacts. It will assist with ensuring that water needs for people and aquatic ecosystems are met in times of water scarcity.

The plan is organized as follows: First, it provides context and outlines the principles that informed plan development. Second, it outlines the responsibilities of agencies at both the provincial and the local levels. Third, it briefly recommends actions to take prior to the onset of drought. Fourth, it describes the four-level drought response plan. This section includes the Drought Indicators Criteria used to determine which level of drought is in effect and an overview of the actions that should be taken

¹ Adapted from definitions in National Drought Mitigation Centre (2006). What is Drought? Accessed at <http://drought.unl.edu/whatis/what.htm>, accessed 31 December 2009.

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by different levels of government and water users. Finally, it recommends actions to undertake after drought conditions have subsided.

While this plan does include some discussion on *drought preparedness* - action taken before a drought to increase the level of readiness by all stakeholders - this is not its primary focus. Issues around drought preparedness and water conservation during normal conditions are addressed in other provincial government policies and guidelines.

This plan is intended primarily to guide actions of staff in provincial government agencies, but it also provides recommended actions for federal government agencies, local government, First Nations and water licensees under the *Water Act*, particularly agricultural users and water purveyors (*see Appendix 1: Detailed Action Tables*).

1.3. Context

Drought response in British Columbia is based on existing legislation and regulations. This plan can be implemented under established legal authorities provided in the *Water Act*, the *Fish Protection Act*, the *Drinking Water Protection Act*, the *Environmental Management Act*, the *Local Government Act* and their supporting regulations. Appendix 3 provides an inventory of key provincial legislation relevant to drought management.

The plan was developed in part by drawing from experience with previous droughts, including the summers of 2003 and 2009, both of which saw extremely low flows for many streams in southern and coastal B.C.

As well, numerous representatives from local governments, First Nations, and other groups, as well as individual water licensees and users, participated in a series of five regional planning workshops from March through May 2010. A workshop for the agriculture sector was held in January 2010. The objective of these events was to engage users and stakeholders in a dialogue on drought planning and to seek input on the development of this plan. The people attending shared their experience and provided invaluable suggestions on managing and preparing for drought, and many of the ideas generated have been incorporated into this plan.

The plan also aims to build on the direction set out in *Living Water Smart: British Columbia's Water Plan*, which includes a number of commitments to improve management of drought, such as:

- ◆ By 2012, water laws will improve the protection of ecological values, provide for more community involvement, and provide incentives to be water efficient.
- ◆ Legislation will recognize water flow requirements for ecosystems and species.
- ◆ Government will require all users to cut back their water use in times of drought or where stream health is threatened.
- ◆ Government will require more efficient water use in the agriculture sector.
- ◆ Government will secure access to water for agricultural lands.
- ◆ By 2012, new approaches to water management will address the impacts from a changing water cycle, increased drought risk and other impacts on water caused by climate change.

1.4. Principles

The following principles guided development of this plan:

Partnership: Federal, provincial and local agencies and stakeholders need to work together to manage drought. British Columbia is a large and climatically diverse province. In any year drought may strike some geographic areas and watersheds while others experience normal conditions or even flooding. Our response to drought must occur at two levels. At the federal and provincial level, agencies' roles include communication and coordination, science, and emergency support services. At the local level, water providers, local governments, First Nations and other authorities undertake duties including data collection, water conservation promotion and enforcement, and emergency response.

Knowledge: Sound science, traditional knowledge, education and innovation are the foundation for adapting to changing environmental conditions. In times of drought, this includes using the best available information on surface water, groundwater, snowpack and soil conditions to assess current and forecasted circumstances.

Stewardship: All British Columbians are responsible for the sustainability of water and aquatic ecosystems. This means that all water users in drought affected areas are asked to cooperate and contribute to the goal of conservation. Wherever possible, reductions in water use will be achieved through voluntary measures, recognizing that it at times it may be necessary to turn to regulatory responses to protect fish, aquatic ecosystems and the rights of water users.

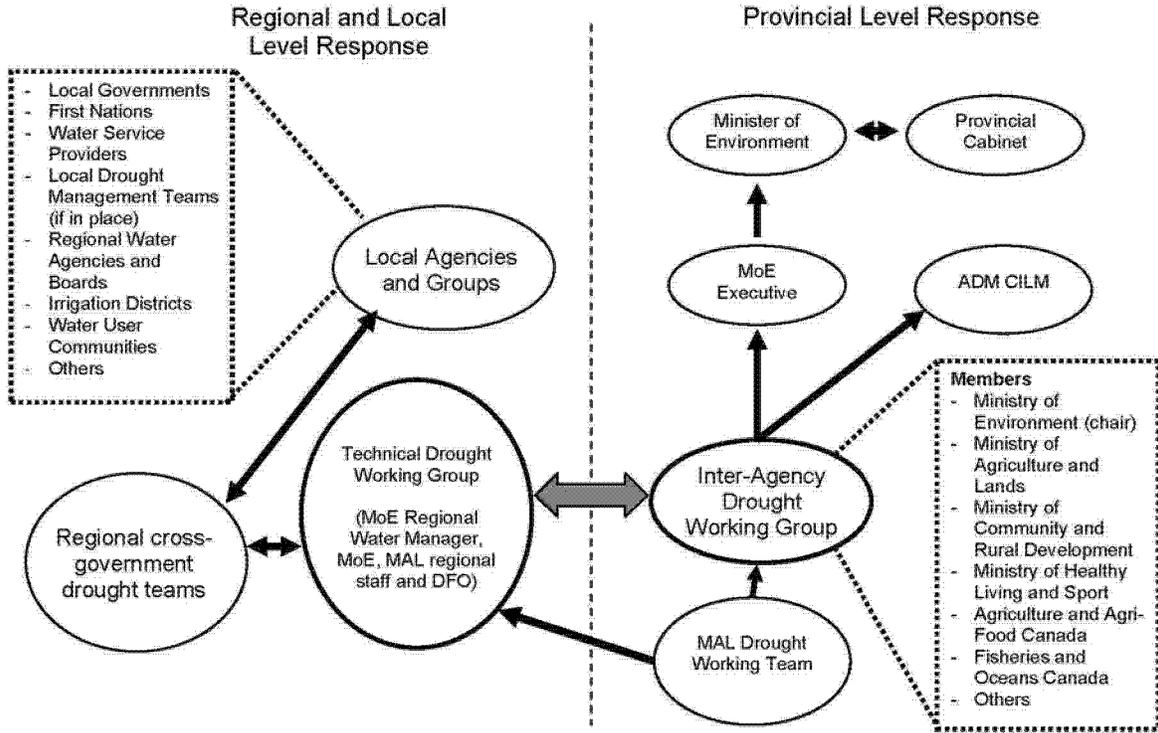
Timely communication: Communicating early in the season is essential to ensuring cooperation and effective water conservation. Providing timely, clear and appropriate information ensures that communities and water users are aware of environmental conditions, can take on shared responsibility, have the opportunity to implement conservation measures and are notified in advance of essential regulatory responses by government.

2. Drought Management Responsibilities

Drought impacts are complex and affect many different sectors of society. As a result, a number of different local, provincial and federal agencies share responsibility for managing and responding to low water events.

Figure 1 demonstrates how key committees and individuals interact with each other during a drought at both the local and provincial level.

Figure 1: Key Coordinating Bodies and Individuals Involved in Drought Response



2.1. Provincial and Regional Level Response

A number of provincial and federal agencies are involved in drought management, summarized in Appendix 4. They cooperate to effectively respond to drought and mitigate its impacts. In order to harmonize their responses, a number of organizing bodies and individual decision makers have been delegated specific responsibilities. These are summarized in Table 1.

Table 1: Key Provincial Level Drought Coordination Committees and Individuals

Who?	Responsibilities
Minister of Environment	<ul style="list-style-type: none"> ◆ Oversight responsibility for managing drought in British Columbia ◆ Issues orders under section 9 of the <i>Fish Protection Act</i>
Assistant Deputy Minister's Committee on Integrated Land Management (ADM CILM)	<ul style="list-style-type: none"> ◆ Oversees the effective provision of integrated natural resource information and services in B.C. ◆ Provides strategic oversight and coordination of all provincial government drought management efforts
MoE Executive	<ul style="list-style-type: none"> ◆ Oversees Ministry of Environment responsibilities for drought management including River Forecast Centre activities and regional office activities ◆ Coordinates with other ministries at a strategic level through the ADM CILM
Regional Water Manager or Comptroller of Water Rights, Ministry of Environment	<ul style="list-style-type: none"> ◆ Makes statutory decisions on water rights under the <i>Water Act</i> ◆ May restrict use by lower priority licensees or those with conditional clauses in their water licence
Inter-Agency Drought Working Group	<ul style="list-style-type: none"> ◆ Ensures effective delivery of the British Columbia Drought Response Plan ◆ Determines when to take regulatory action under the <i>Fish Protection Act</i> ◆ Ensures that roles and responsibilities during low flow and drought conditions are clearly defined, communicated and understood both internal and external stakeholders ◆ Ensures that "lessons learned" from droughts are documented and transferred internally and externally
Technical Drought Working Group	<ul style="list-style-type: none"> ◆ Ensures effective delivery of the British Columbia Drought Response Plan ◆ Coordinates operational level cross-agency response to drought or low streamflow conditions ◆ Determines when to elevate drought levels at the basin scale. ◆ Works with regional cross-government drought teams who determine when to elevate the current drought level to the next level in specific watersheds and streams ◆ Works with regional cross-government drought teams to issue advisories/notifications on drought conditions ◆ Determines when to take regulatory action under the <i>Water Act</i> (Regional Water Manager Responsibility)
MAL Drought Working Team	<ul style="list-style-type: none"> ◆ Assesses role of MAL staff within Technical Drought Working Group ◆ Assesses impacts of drought on dry land farming areas and range capacity to carry livestock ◆ provides lead drought response in non irrigated areas and assesses livestock needs in drought stricken areas ◆ Assesses livestock feed requirements ◆ Provides information on drought programs and initiatives to producers by liaising with BC Agriculture Council and Agriculture and Agri-food Canada
Regional Cross-Government Drought Teams	<ul style="list-style-type: none"> ◆ Provides advice on region and watershed specific drought response levels based on best available scientific data ◆ Issues advisories/notifications on drought conditions ◆ Supports pre-drought preparedness in BC's most drought vulnerable regions.

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The Inter-Agency Drought Working Group (IADWG), chaired by a manager in the Ministry of Environment, has a particularly important role in responding to low water situations. This committee, with membership drawn from key provincial and federal government agencies, is tasked with ensuring that the Drought Response Plan is fully delivered. Reporting to the IADWG, the Technical Drought Working Group (TDWG) consists of members from regional cross-government drought teams with membership from MoE, MAL and DFO. These teams conduct the work in each region to evaluate and determine when to elevate drought levels for watersheds and streams, discussed in more detail in Section 4. The TDWG ensures that regional teams can coordinate responses across the province. This group also ensures that specific actions set out in this plan are considered and delegated to the appropriate person or body for further action and that drought conditions are clearly understood and communicated to internal and external stakeholders.

The MAL Drought Team provides coordination to MAL staff on the Technical working groups and coordinates with agricultural commodity groups and Agriculture and Agri-food Canada.

The Inter-Agency Drought Working Group meets at least once every year and on an as needed basis when dry conditions or low streamflows prevail. The TDWG meets monthly prior to the onset of drought and bi-weekly if drought conditions or low streamflows occur and require more immediate action. The regional cross-government drought teams and the MAL Drought Working Team meet on an as needed basis and provide a link with the provincial Regional Management Committee to coordinate if additional resources are needed for effective drought response.

2.2. Local Level Response

Local responses are essential to managing drought. At the local level, emphasis is placed on collecting information, delivering programs, communicating with residents and responding to emergencies.

2.2.1 Local Authorities

Local authorities that may be involved in drought management include local governments, water service providers, First Nations and other regional agencies with responsibilities for water (e.g. the Okanagan Basin Water Board, the Columbia Basin Trust, the Salmon River Watershed Roundtable, Nicola Water Use Management Plan etc.).

The structure of governance arrangements for water varies from region to region, as do climatic and geographic conditions, so it is appropriate that there will be different organizational approaches to drought preparedness and response. There is no “one size fits all” solution for British Columbia.

Roles of local authorities may include the following:

- ◆ gathering available drought information for the community;
- ◆ identifying information gaps;
- ◆ targeting water management needs;
- ◆ implementing water conservation strategies;
- ◆ managing community water supplies; and,
- ◆ communicating with the public.

Early and frequent communication about water supply conditions and responses is key to successful drought management. Local authorities may use a combination of communication tools, water supply data, regulatory instruments and other tools to advocate for water conservation across the community. They may communicate directly with residents about drought management goals, actions, water supply status, and forecasts. They can also conduct one-on-one meetings with major water users in the community to discuss water conservation plans, and their role in implementation.

Local authorities may also establish or participate on multi-agency Local Drought Management Teams, which would work with the regional cross-government teams to coordinate responses. These local teams may lead the development of Local Drought Management Plans.

2.2.2 Local Drought Management Teams

Local Drought Management Team may be established by local authorities and/or other groups (such as stewardship groups) with a mandate to provide a coordinated regional response. Their focus should be on current low water conditions. However, they may also operate during normal conditions to focus on longer term preparedness strategies. The responsibilities of a local drought management team may include:

- ◆ acting as an advisory committee to local politicians and staff regarding water conservation and drought management projects and programs;
- ◆ compiling data on water supplies and users in specific watersheds;
- ◆ coordinating efforts with various stakeholders (including the fisheries sector, the agricultural sector, industry, recreation groups and neighbouring communities);
- ◆ providing timely information to the public about water supplies; and,
- ◆ continually encouraging water conservation and appropriate responses to drought conditions;
- ◆ coordinate communication on low streamflows and drought, through the establishment of a local drought communication plan.

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Membership should be modified and adapted to suit local circumstances, but may include:

- ◆ representatives of local water users;
- ◆ local governments;
- ◆ First Nations
- ◆ water suppliers;
- ◆ non-government agencies;
- ◆ business and recreation sector groups; and,
- ◆ staff from provincial and federal government regional offices.

Local Drought Management Teams typically do not possess any unique legislative authority but may advise decision makers on the timing and use of regulatory tools such as the *Water Act* and the *Fish Protection Act*.

The scale at which teams operate may vary. They could be tasked to manage specific watersheds, but may focus on larger geographic areas or sub-watersheds depending on local climate, geography and other circumstances.

Some areas in British Columbia already have multi-stakeholder committees that address water sustainability issues. These committees may assume the responsibilities of Local Drought Management Teams if appropriate.

2.2.3 Local Drought Management Plans

Local Drought Management Plans are developed by local authorities and/or Local Drought Management Teams. They are intended to build on and provide further detail to the plans and actions set out in this document, but specific to the geographic region they cover.

They should identify local drought stages and corresponding actions and responses. They should clearly assign responsibilities for these actions to an appropriate local agency or stakeholder group. Ideally these plans will be in place prior to the onset of drought and will be recognized and supported by the major water users in the watershed. Typically a Local Drought Management Plan will include:

- ◆ documentation on the water system profile;
- ◆ evaluation of the potential impacts of drought on the region's economy;
- ◆ data requirements, frequency of data collection and reporting protocols on local water supplies and climate;
- ◆ clear definitions of local drought stages and corresponding local responses;
- ◆ communication plans; and,
- ◆ documentation on the membership and operating procedures of the Local Drought Management Team.

Local Drought Management Plans should be informed by and correspond to the goals of this document (the British Columbia Drought Response Plan), the *Water Act*, the *Drinking Water Protection Act*, provincial water policy and other local water management plans.

The Ministry of Environment has recently updated a useful guidance documents entitled *Dealing with Drought: A Handbook for Water Suppliers in British Columbia, 2009 Update*. It includes planning templates for Local Drought Management Plans, for water supply and demand analysis and for emergency drought consequence plans. See Appendix 7 for information on how to access this and other resources.

2.2.4 Water Bailiffs

Another important role that is filled at the local level is that of the water bailiff. Under Section 35 of the *Water Act* the Comptroller of Water Rights can appoint a water bailiff to manage conflicts in a stream before or during a drought. These people are given the authority to enter on any land and to regulate and control the diversion and use of water from the streams they are appointed to. They can also regulate and control all diversion works on these streams. They may help enforce watering restrictions and gain a better understanding of how water is used by both residents and agricultural producers. Provided there is cooperation among water users, water bailiffs can play a key role in monitoring stream conditions on the ground and can help ensure there are flows for fish and aquatic ecosystems.

3. Pre-Drought Preparedness

Droughts can vary dramatically in duration and severity and be difficult to forecast. They can result in great social and economic upheaval, requiring the concerted efforts of numerous parties if a response is to be effective. It is best to not delay preparing for them until the last minute.

During normal conditions, there is much that communities and individual water users can do to prepare for drought, particularly by targeting ongoing improvements in household, industry and agricultural water use efficiency.

At the provincial level, the main activities undertaken to prepare for drought include:

- ◆ monitor and characterize streamflows and lake levels; (MoE in partnership with other organizations);
- ◆ deliver seasonal volume forecasts based on meteorological, hydrometric and snowpack data and the use of hydrological models (MoE);
- ◆ provide regular updates on streamflow and groundwater data on the internet (MoE);
- ◆ develop, refine and maintain hydrological hazard and risk models to guide community planning and emergency response (MoE);
- ◆ monitor water levels in priority aquifers through the Provincial Observation Well Network (MoE);
- ◆ monitor snowpack conditions using automated and manual techniques to support streamflow forecasting (MoE);
- ◆ monitor the Drought Code and Fire Danger Class (MoE to access MFR data);
- ◆ maintain infrastructure and systems that support monitoring, data collection and data processing (MoE);
- ◆ conduct data quality assurance and auditing on water and snow related data collected using up-to-date standards (MoE);

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- ◆ work with water purveyors and local communities to ensure that they have the necessary information to respond when droughts are forecast (MoE, MCRD);
- ◆ provide local governments and water suppliers with planning tools to prepare for drought (MoE, MCRD);
- ◆ implement the *Drinking Water Protection Act* (MHLS in partnership with other organizations);
- ◆ maintain a list of available contractors in each region that can be called in as needed;
- ◆ prepare and update factsheets, guidelines and policies to aid agricultural producers to understand, prepare for and manage drought (MAL); and,
- ◆ maintain and up-date provincial drought management policies, procedures and plans including this document (MoE, MAL, MCRD, MHLS).

At the local level, the main activities undertaken by local authorities and water licensees to prepare for drought include:

- ◆ establish Local Drought Management Teams;
- ◆ gather available local information on historic droughts, water supply and climate conditions; identify information gaps;
- ◆ complete water supply plans, local drought management plans and emergency drought consequence plans; update and practice implementation of plans annually;
- ◆ establish water conservation strategies and water use reduction targets;
- ◆ implement water conservation programs; continuously improve water use efficiency;
- ◆ encourage water conservation, stewardship and education through local media;
- ◆ incorporate water conservation into planning and daily operations;
- ◆ continuously improve the efficiency of agricultural irrigation systems;
- ◆ agricultural producers should consider water status from the previous season when planning the next year's production. Soil water levels, reservoir levels, streamflows, snowpack and groundwater levels are all important factors;
- ◆ agricultural producers should review information on crop selection, irrigation efficiency and water conservation; and
- ◆ municipal authority is required to enforce water restrictions. Local governments should develop bylaws for water conservation, drought management and emergency drought preparedness to respond to diminishing streamflow and water storage conditions.

4. Drought Response Levels, Indicators and Actions

4.1 Drought Response Levels

The B.C. Drought Response Plan is organized around four successive levels of drought targeted at the water basin and watershed/stream levels. In early season (January to May) the levels represent a forecast of potential drought conditions. Only in late June can the likelihood and extent of drought be assessed based, among other indicators, on streamflows and precipitation.

For the late June to October season, at Level 1 (Green), conditions are normal and there is sufficient water to support ecosystem and socio-economic needs. Emphasis is

on preparedness and taking action in advance of droughts in order to increase readiness of water users and communities when they inevitably occur. This level is only addressed at a summary level in this plan in Section 3, above.

At Level 2 (Yellow), conditions are dry and first indications of potential water supply shortages are recognized. Emphasis is on stewardship and voluntary conservation through education, communication and planning.

At Level 3 (Orange), conditions are becoming very dry. Potentially serious ecosystem or socio-economic impacts are possible and minor impacts may already be occurring. Emphasis continues to be on voluntary conservation but increasing use of watering restrictions may be imposed by water service providers.

At Level 4 (Red), conditions are extremely dry and there is insufficient supply to meet community or ecosystem needs. Progressively more severe and widespread socio-economic impacts are expected. Voluntary measures and increasing use of restrictions will continue but may be augmented by regulatory responses by the provincial government including use of authorities provided under the *Water Act*, the *Fish Protection Act* and other legislation.

Further action including emergency responses may be required in the event that a community or system experiences complete loss or near loss of supply. However, planning for such events is outside the scope of this plan.

As noted above, British Columbia is a place of significant climatic diversity. These levels are intended to be applied in water basins and where feasible, based on the best available scientific data, within specific watersheds. It is therefore likely that different areas and watersheds will be at different levels of response during any given drought year.

The different levels and their corresponding objectives and suggested water use targets are summarized in Table 2. Actual water use targets will depend on the regional conditions and the likelihood of drought.

Table 2: Drought Response Levels Summary

Level	Conditions	Significance	Objective	Target
1 (Green)	Normal Conditions	There is sufficient water to meet human and ecosystem needs	Preparedness	Ongoing reductions in community water use
2 (Yellow)	Dry Conditions	First indications of a potential water supply problem	Voluntary conservation	Minimum 10% reduction
3 (Orange)	Very Dry Conditions	Potentially serious ecosystem or socioeconomic impacts are possible	Voluntary conservation and restrictions	Minimum additional 20% reduction
4 (Red)	Extremely Dry Conditions	Water supply insufficient to meet socio-economic and ecosystem needs	Voluntary conservation, restrictions and regulatory response	Maximum reduction
Loss of Supply		Potential loss of a community's potable or fire fighting supply	Emergency response	Ensure health and safety

4.2 Drought Indicators Criteria

The Drought Indicators Criteria described in this section assists decision makers with determining when it is necessary to elevate drought response to incrementally higher levels in any particular region or watershed in the province.

Measuring drought is a complex process, particularly in a place like British Columbia with its geographic diversity and complex regional microclimates. Most indicators also require comparison to other droughts, which demands robust sets of historical climatic data.

Analysis of previous droughts indicates that there are three major factors involved with drought occurrence: low winter snow accumulation (as measured near the end of the winter), spring weather (low precipitation during May and June) and summer weather (low precipitation during July and August). For drought to occur, often two of the three factors need to exist. For severe drought (as in 1929, 1931, 1955, 2003 and 2009), often all three factors need to exist, in addition to multiple years of reduced precipitation. As a result, multiple indicators usually need to be consulted to know if drought is occurring or likely.

British Columbia's drought indicators need to focus on the causative factors (snow conditions, spring and summer precipitation, preceding drought) and the resultant factors (streamflow, lake and reservoir levels).

The Drought Indicators Criteria is comprised of four core indicators and a number of supplemental indicators. The core indicators are as follows:

- ◆ Basin Snow Indices;
- ◆ Seasonal Volume Runoff Forecasts;
- ◆ 30 Day Percent of Average Precipitation; and
- ◆ 7-Day Average Streamflow

These core indicators were chosen because data tends to be readily available, they are relatively easy to use and communicate, and MoE's River Forecasting Centre and other agencies have experience working with them. Good historical data is usually available. They can be used to speak consistently about water supply in particular watersheds while also allowing for meaningful comparisons across the province.

The following provides a very brief description of each indicator.

Basin Snow Indices: calculated as the mean of snow water equivalent values (expressed as % of the 1971-2000 normal) for representative snow courses and snow pillows in major river basins in B.C. The critical reporting dates are the first days of the month from January through to May.

Volume Runoff Forecasts: this indicator is based on multi-variate statistical analysis, and is quantitative forecasts of seasonal runoff (e.g., Mar-Aug, Apr-Aug, or Mar-Jun, Apr-Jun) for river basins. These forecasts have the advantages of being quantitative, consistent, repeatable, and having definable confidence limits.

30 Day Percent of Average Precipitation: a simple measurement of rainfall for a single region or a single season. It is calculated by dividing actual precipitation by normal precipitation - typically considered as a multi-decade mean - and multiplying by 100%. Normal precipitation for a specific location is considered to be 100%. Percent of Average Precipitation is tracked by Agriculture and Agri-Food Canada and data is readily available at a number of different timescales online (see http://www.agr.gc.ca/pfra/drought/mapscc_e.htm). The 30 day time scale is used for this criterion, but other timescales - 60, 90 or 180 days - will also usually be referred to.

7-Day Average Streamflow: As the name suggests, this indicator looks at 7-day average streamflows in selected systems expressed as a percentage of the historic median. It uses a weekly average streamflow for a number of different streams in a particular region or watershed. Data is sourced from indicator Water Survey of Canada hydrometric stations.

In addition to the core indicators, the Technical Drought Working Group may also refer to additional information from the supplemental indicators. Although there are no quantitative thresholds associated with these supplemental indicators, they may be used to help assess current and forecasted drought conditions and may be used at the local level to help guide activities and planning, particularly at higher levels of drought alert (i.e. Levels 3 and 4). Supplemental indicators that may be considered include:

- ◆ aquifer levels;
- ◆ individual indicator hydrometric station results;
- ◆ multi-year trends;
- ◆ reservoir inflows;
- ◆ wildfire danger class ratings, tracked by the MFR - Wildfire Management Branch
 - (see http://bcwildfire.ca/Weather/Maps/danger_rating.htm).

Table 3 provides a summary of the different indicators and their time of use. Table 4 sets out the quantitative thresholds for the core indicators.

Table 3: Drought Indicators Criteria Summary

		Timing of Use	
		Early Season (Jan-May)	Seasonal (June-Oct)
Indicator	Core Indicators	Basin Snow Measures Seasonal Volume Runoff Forecasts	7-Day Average Streamflow 30 Day Percent of Average Precipitation
	Supplemental Indicators	Aquifer Levels Individual Indicator Hydrometric Station Results Multi-Year Trends Reservoir Inflows Wildfire Danger Class Ratings	

Table 4: Core Indicator Thresholds

	Level 1 (Green)	Level 2 (Yellow)	Level 3 (Orange)	Level 4 (Red)
Basin Snow Measures \pm	>80%	80-65% of normal	<65% of normal	
Seasonal Volume Runoff Forecasts	>80%	80-61% of normal	60-45% of normal	<45% of normal
30 Day % of Average Precipitation \yen	>80%	80-51% of average	50-25% of average	<25% of average
7-Day Average Streamflow	>25 percentile	11-25 percentiles	6-10 percentiles	<6 percentiles

\pm : Basin Snow Measures would not normally be relied on as a basis for elevating drought response to Level 4 (Red). However, the Inter-Agency Drought Working Group may decide that this elevation is warranted in the case of exceptionally low results.

\yen : The 30 day time scale is used for this criterion, but other timescales - 60, 90 or 180 days - will also usually be referred to.

4.3 Moving From One Level to Another

The Technical Drought Working Group determines when to move to an elevated level of drought response - Level 1 (Green) through to Level 4 (Red) - in any particular watershed or geographic area based on consideration of the Drought Indicators Criteria, the advice of local authorities and other factors.

The Technical Drought Working Group, in collaboration with the Regional Cross-Government Drought Teams consider the current and forecasted status of all the core indicators in the Drought Indicators Criteria to determine the severity of the drought. Each measure and index serves only as a relative guide. Decisions may be based on what the majority of indicators show or may be based on any one particular indicator. The group may also consider results from the supplemental indicators and other information as appropriate.

During drought years, the Drought Indicators Criteria are re-assessed at a minimum of once a month and the drought levels are typically only adjusted monthly to facilitate a smooth transition for water users and to allow time for conservation measures to take effect. However, in some cases it may be necessary to use finer time scales. For example, MoE's River Forecast Centre analyzes average streamflow data on a weekly basis. Results of this analysis may warrant escalating to a higher level of drought response more frequently than monthly.

In exceptional circumstances the Technical Drought Working Group may determine that it is necessary to "leapfrog" over one level to a subsequently higher one. For example, it may be necessary to move directly from Level 1 to Level 3 or Level 4.

Re-assessment of Drought Indicators Criteria may also lead to easing back of drought levels, such as a movement between from level 3 to level 2 due to changing conditions. For example, Basin wide drought level forecasts based on low snow pack may be eased by above average precipitation in spring.

At Level 4, the Inter-Agency Drought Working Group determines, based on the information provided by the Technical Drought Working Group, when to take regulatory action under the *Fish Protection Act*. Regulatory action under the Water

Act will be determined by the Regional Water Manager, in consultation with the Inter-agency drought working group.

4.4 Summary of Drought Response Actions

This section provides a high level summary of actions that may be undertaken at each level of drought. A much more detailed inventory of actions is provided in tables in Appendix 1. The activities that follow are intended as general guidance for provincial drought response actions and will mostly be used during drought season (June-October). Early season (January-May) actions are not anticipated to reach Level 4 or include regulatory measures, and will consist mainly of communication with water users. Early season drought levels are an indication of potential drought during the months of June through October. Precipitation in May and June will determine the potential for, the extent and severity of a drought in various regions across BC. In addition, every drought is different and creative responses are required to meet the situation at hand and unforeseen circumstances. Deviation from specific actions listed in the framework below is expected and proper.

Level 1 (Green)

At Level 1, conditions are normal and emphasis is on drought preparedness. The appropriate actions at both the provincial and local level are summarized in Section 3, above.

Level 2 (Yellow)

At Level 2, emphasis is on stewardship and voluntary conservation through education, communication and planning. As a general guideline, water users should target a minimum 10% reduction in water use. The overall objective is to begin preparations under the precautionary assumption that streamflow conditions may deteriorate further. Key actions that should be undertaken include the following:

- issue province-wide news release and targeted news releases in impacted geographic regions;
- issue information bulletins to local governments, water suppliers, First Nations, industry and stewardship groups, major licensees and other key stakeholders in impacted water basins and specific watersheds/streams;
- review water conservation advice, guidelines and materials for local government, water suppliers and agricultural producers and update as appropriate;
- where appropriate, advise agricultural producers to take early actions such as filling reservoirs and filling soil profiles with freshet water if available;
- use direct and indirect communications to request water licensees voluntarily work together, conserve, share water and consider in-stream needs;
- local governments introduce outdoor watering restrictions;
- increase monitoring effort as required on streamflow conditions and aquifer levels in impacted geographic regions.

Level 3 (Orange)

At Level 3, conditions are becoming very dry. Emphasis continues to be on voluntary conservation but increasing use of watering restrictions may be imposed by water service providers. As a general guideline, water users should aim to reduce use by a minimum additional 20%. Key actions that should be undertaken include the following:

- ☑ intensify communication efforts as appropriate based on current conditions; issue updated province-wide news release;
- ☑ continue to issue local media releases and/or targeted advertizing to advise of watering restrictions, encourage conservation, provide updates on local water supply status and forecast future conditions specific to the community;
- ☑ provide regular direct updates to local governments, water suppliers, First Nations, industry and stewardship groups, major licensees and other key stakeholders in impacted geographic regions;
- ☑ advise high volume water licensees (or all licensees on high risk streams) directly of conditions via mail and request that they implement voluntary conservation measures;
- ☑ local governments implement next stage watering restrictions to achieve targeted reduction in water use; enforce compliance through bylaws.
- ☑ provide access to waiver for agricultural producers seeking to meet minimum production levels to maintain farm status for tax purposes, [thereby avoiding unnecessary use of water]

Level 4 (Red)

At Level 4, voluntary measures and increasing use of restrictions will continue but may be augmented by regulatory responses by the provincial government. This may include mandatory reductions or cessation of water use. Water users should work together to minimize water use wherever possible in order to ensure that community and ecosystem needs will be met. Key actions that should be undertaken include the following:

- ☑ increase frequency of communication by all levels of government and water suppliers with all water users through media, advertizing, internet, email updates and other channels;
- ☑ continue to issue information bulletins to local governments, water suppliers, First Nations, industry and stewardship groups, major licensees and other key stakeholders in impacted geographic regions;
- ☑ local governments implement progressively stricter watering restrictions to achieve targeted reduction, including outdoor watering bans where necessary;
- ☑ implement regulatory controls under the *Water Act*, *Fish Protection Act* or other statutes (such as Federal action under the *Fisheries Act*) as appropriate if voluntary measures are not enough to protect water users and fish;
- ☑ Consider diverting available water from annual crops to perennial crops and higher value crops to keep them alive for future years.
- ☑ provide assistance to communities seeking alternative or temporary water supplies;
- ☑ prepare for emergency response where risk of loss of supply exists.

4.5 Loss or Failure of Supply

The extreme outcome of drought is loss, near loss or failure of a community's potable water supply or supply for fire fighting. In this event the objective becomes an emergency response and protecting public health and safety.

Local governments and water purveyors should monitor their situation closely to ensure that mitigation measures undertaken are sufficient to prevent the loss or failure of water supplies. Where loss or failure is imminent, local governments should contact the province through the Drinking Water Officer, Ministry of Healthy Living and Sport (MHLS) and EMBC.

Water purveyors remain responsible for ensuring that water supplies are adequate to maintain public health and safety. Local governments are the lead support for water purveyors and, where necessary, the provincial emergency management framework will be utilized to address community specific requirements.

The provincial emergency management framework is activated when a local government requires support to manage an emergency or disaster. References to sources for more information on emergency management in British Columbia can be found in Appendix 7. Specific actions for emergency response are outside the scope of this plan.

Local authorities can find detailed guidance on developing Emergency Drought Consequence Plans in *Dealing with Drought: A Handbook for Water Suppliers in British Columbia, 2009 Update*, available on-line (see Appendix 7 for more information).

In the event that loss of supply occurs or is forecast, local authorities should follow the steps in their Emergency Drought Consequence Plan and, where appropriate, their Emergency Response and Contingency Plan as required by the Drinking Water Protection Act. Depending on circumstances it may be necessary to impose comprehensive and closely monitored watering restrictions, allocate water on a per capita basis, seek use of alternative water supplies or declare a state of emergency.

All emergency situations that affect the health and safety of the public should be reported to Emergency Management B.C. at 1-800-663-3456.

5. Post-Drought Actions

Following the end of a drought, emphasis should shift to maintaining the resources affected and to applying the lessons learned to improve long term water sustainability. Some tasks to consider include:

- ◆ the Technical Drought Working Group should retract existing drought ratings and advise of return to Level 1 (Green);
- ◆ water suppliers should restore operations and ensure that drought-driven systems improvements and modifications are in compliance with relevant standards;

- ◆ provincial and federal data and information providers may review the effectiveness of systems to monitor and characterize streamflows, lake and reservoir levels, snowpack and groundwater during the drought and implement any identified improvements;
- ◆ the Inter-Agency Drought Working Group, the Technical Drought Working Group, and other involved parties should hold a post drought workshop to assess the equity, efficiency and effectiveness of communications, information, actions and monitoring that were undertaken. Lessons learned should be documented. This might result in recommended improvements to:
 - Local Drought Management Plans;
 - terms of reference for the Inter-Agency Drought Working Group and Technical Drought Working Group;
 - this plan (the British Columbia Drought Response Plan);
 - other provincial policies, guidelines and fact sheets;
 - amendments to provincial legislation and municipal bylaws;
- ◆ stakeholders and individuals who demonstrated a strong stewardship ethic during the drought should be profiled and publicly recognized;
- ◆ revisit established water conservation strategies and reduction targets; continuously improve community water use efficiency.

6. Future Refinements

This plan is considered a “living document” and may be updated and improved from time to time based on experiences. Changes may be made based on the approval of the Inter-Agency Drought Working Group, in consultation with the Technical Drought Working Group.

The provincial government has indicated in *Living Water Smart: British Columbia's Water Plan* that water laws will be improved to protect ecological values, provide for more community involvement, and provide incentives to be water efficient. While this plan can be implemented under established legal authorities, further modifications may be required in response to potential future improvements to provincial legislation.

Appendix 1: Detailed Action Tables

Level 2 (Yellow) Actions

Level:	Level 2 (Yellow)	
Objective:	Voluntary conservation among all sectors and users	
Target:	Minimum 10% reduction in total water use	
Actions:	Lead Responsibility	
Communication and Coordination		
Notify IADWG and TDWG; reaffirm duties and responsibilities; schedule regular meetings for duration of dry season	MoE (Chair IADWG)	
Update drought communications plans based on streamflow conditions and forecasts in impacted geographic regions	MoE (Chair IADWG) PAB	
Initiate direct contact and information exchange protocols between key contacts in MoE and DFO	MoE DFO	
Initiate direct contact and implement information exchange protocols between MoE and key contact(s) in water suppliers in impacted geographic regions	MoE (Regions) Local government and water suppliers	
Initiate direct contact and implement information exchange protocols between MAL and key agricultural industry groups in impacted geographic regions	MAL	
Initiate direct contact and information exchange between MoE and key contact(s) in the MFR-Wildfire Management Branch in impacted geographic regions to coordinate on wildfire threats and potential impact on water supplies, including use of water in fire fighting	MoE (Chair IADWG) MFRMFR Office of Fire Commissioner	
Issue province-wide news release and targeted news releases in impacted geographic regions	MoE PAB	
Issue information bulletin to local governments, water suppliers, First Nations, industry and stewardship groups, major licensees and other key stakeholders in impacted geographic regions	MoE	
Issue and distribute Low Stream Flow Advisories as required in impacted geographic regions	MoE DFO	
Provide regular updates via email to local governments, water suppliers, First Nations, industry and stewardship groups, major licensees and other key stakeholders in drought areas	MoE	
Update MoE drought and RFC internet sites to provide up-to-date streamflow and groundwater data and information	MoE (Chair IADWG) MoE	
Use local media releases and/or targeted advertizing to advise of watering restrictions, encourage conservation, provide updates on local water supply status and forecast future conditions	Local government and water suppliers	
Review water conservation advice, guidelines and materials for local government and water suppliers and update as appropriate	MoE MCRD	
Review water conservation advice, guidelines and materials for agricultural producers and irrigators and update as appropriate	MAL	
Where appropriate, advise agricultural producers to take early actions such as filling reservoirs and filling the soil reservoir where possible.	MAL	
Coordinate with Agriculture and Agri-food Canada drought response equipment such as pumps for dugout filling.	MAL	
Designate local spokesperson to coordinate interaction with the public and media on local level issues	MoE PAB	

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Level:	Level 2 (Yellow)	
Other Actions		
Notify local governments and water suppliers that they should communicate with residents and businesses to request voluntary conservation efforts		MoE (Chair IADWG) MCRD
Implement appropriate watering restrictions to achieve targeted reduction in water use		Local government and water suppliers
Temporarily discontinue issuing major new water licences or short term use approvals as appropriate		MoE (Regions)
Request provincial government agencies to conserve water at public facilities, particularly outdoors		MoE (Chair IADWG)
Use direct and indirect communications to request water licensees voluntarily work together, conserve, share water and consider in-stream needs		MoE (Regions)
Review inventory list of sensitive ecoregions, specific streams and identify likely fish sensitive periods		(MoE ESD)
Encourage and train agricultural producers on the use of irrigation scheduling techniques and other tools such as the on-line irrigation scheduling calculator on specific streams		MAL
Monitoring		
Increase monitoring effort as required on streamflow conditions and aquifer levels in impacted geographic regions		MoE MoE (Regions) DFO
Monitor stream conditions for additional information such as dry riffles, reported fish deaths, water temperature, etc. in impacted geographic regions		MoE MoE (Regions) DFO
Monitor community and licensee water use		MoE (Regions) Local government and water suppliers
Monitor and enforce compliance with restrictions and allocations through bylaws		Local government and water suppliers
Documentation and Preparation for Next Level		
Develop a database of water licensees and short term use approval holders on streams that have or may have Low Stream Flow Advisories issued		MoE MoE (Regions)
Identify and prepare to use additional communication channels for next level including social media (e.g. facebook) and mass media advertizing		MoE (Chair IADWG)
Identify possible community groups and key stakeholders that may assist with information distribution in next phase		MoE (Regions)
Inform ADM CILM and Minister of Environment of possible move to Level 3 (Orange)		MoE (Chair IADWG) MoE (Executive)
Document conservation actions taken to date; maintain registry of groups and individuals contacted		MoE (Chair IADWG) MoE (Regions) MAL

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Level 3 (Orange) Actions

Level:	Level 3 (Orange)	
Objective:	Voluntary conservation and restrictions	
Target:	Minimum additional 20% reduction in total water use	
Actions:	Lead Responsibility	
Communication and Coordination		
Increase frequency of IADWG meetings as appropriate	MoE (Chair IADWG)	
Intensify communication efforts as appropriate based on current streamflow conditions; issue updated province-wide news release and targeted news releases with updated information and conservation requests in impacted geographic regions	MoE PAB	
Hold media news conference to announce activation of additional drought measures and to provide updated information; outline media plan to notify public of changes to streamflows and additional conservation measures	MoE PAB	
Continue to issue local media releases and/or targeted advertizing to advise of watering restrictions, encourage conservation, provide updates on local water supply status and forecast future conditions specific to the community	Local government and water suppliers	
Continue provision of regular updates on streamflow and groundwater data on the internet; increase frequency of updates as appropriate	MoE	
Advise high volume water licensees (or all licensees on high risk streams) directly of conditions via mail and request they implement voluntary conservation measures	MoE (Regions)	
Provide regular updates via email to local governments, water suppliers, First Nations, industry and stewardship groups, major licensees and other key stakeholders in impacted geographic regions; intensify frequency of updates as appropriate	MoE (Chair IADWG) MoE	
Commence utilization of additional communication channels as appropriate to inform water users and the public about drought conditions including print advertizing, social media (e.g. facebook), community and agricultural associations, etc.	MoE MAL PAB	
Ensure ongoing direct contact between key contacts in MoE and EMBC; review information exchange protocols on drought and emergency response	MoE EMBC	
To reduce water use on streams for which an order from MOE is under consideration, provide the first communication with producers on the process and requirements that are to be followed.	MAL	
Clearly communicate to agricultural producers the watersheds where the minimum income requirement to maintain farm status for tax assessment purposes will be waived.	MAL	
Prepare to provide access to information on stress management resources for agricultural producers as required via internet and other forums	MAL	
Prepare information on provincial and federal drought programs that can assist producers to help cope with drought	MAL	
Organize workshops for producers in affected areas to provide guidance on water conservation activities, drought assistance programs and processes for application if appropriate	MAL AAFC	
Submit drought assessment reports as necessary to deputy ministers and other senior executives	MoE (Chair IADWG) MoE (Executive)	

Level:	Level 3 (Orange)	
Other Actions		
Impose restrictions as appropriate based on priority water licence rights, in addition to voluntary water conservation requests		MoE (Regions)
Limit the number of, or impose restrictions on, new licences, regulate storage or invoke conditions on existing licences		MoE (Regions)
Implement next stage watering restrictions to achieve targeted reduction in water use		Local government and water suppliers
Eliminate filling of public fountains and watering of public parks, gardens, medians and other similar areas		Local government and water suppliers
Limit new connections or uses as appropriate		Local government and water suppliers
Request Stop Work Diversion Initiatives on Flow Sensitive Fish Streams as appropriate		MoE (Regions) DFO
Ensure that water bailiffs are appointed and active on appropriate streams in drought areas; complete any necessary briefings or training with water bailiffs		MoE (Regions)
Modify flood prevention, flow augmentation and power generation reservoir activities as appropriate to minimize impact of drought		BC Hydro Local government and water suppliers
Provide technical assistance and specific measures to water suppliers experiencing problems with system management or promotion of conservation		MCRD
Commence reporting on status of water supplies and forecasted future scenarios to MoE		Local government and water suppliers Potential help from Drinking Water Protection Officers
Request provincial government agencies elevate efforts to conserve water at public facilities		MoE (Chair IADWG)
Implement drought assistance programs such as dugout filling in regions that are affected		AAFC
Monitoring		
Monitor and enforce compliance with next stage restrictions and allocations through bylaws		Local government and water suppliers
Prioritize and intensify monitoring of stream conditions as required in impacted regions; identify most efficient alternatives for monitoring		MoE MoE (Regions) DFO
Continue to monitor water use by communities and water licensees; increase monitoring as required		MoE (Regions) Local government and water suppliers
Monitor and enforce compliance with restrictions and allocations through bylaws; increase enforcement effort as appropriate		Local government and water suppliers
Documentation and Preparation for Next Level		
Identify additional groups and associations that may assist with actions at next level		MoE (Regions)
Inform ADM CILM and Minister of Environment of possible move to Level 4 (Red) and identify impacted geographic regions		MoE (Chair IADWG) MoE (ADM Office)
Assess impacts to livestock and crops in drought affected regions that are currently not irrigated		MAL
Identify and document needs of agriculture in areas supplied by high risk streams		MAL
Document conservation actions taken to date; maintain registry of groups and individuals contacted; record potential social, environmental and economic impacts		MoE (Chair IADWG) MoE (Regions) MAL

Level 4 (Red) Actions

Level:	Level 4 (Red)	
Objective:	Voluntary conservation, restrictions and regulatory responses as required	
Target:	Maximum reduction	
Actions:		Lead Responsibility
Communication and Coordination		
Increase frequency of communication by all levels of government and water suppliers with all water users through media, advertizing, internet, email updates and other forums		MoE Local government and water suppliers
Increase frequency of communication between MoE and EMBC regarding geographic areas of concern		MoE (Chair IADWG) EMBC
Continue to issue information bulletins to local governments, water suppliers, First Nations, industry and stewardship groups, major licensees and other key stakeholders in impacted geographic regions		MoE
Continue to issue and distribute Low Stream Flow Advisories as required in impacted geographic regions		MoE DFO
Continue to provide regular updates via email to local governments, water suppliers, First Nations, industry and stewardship groups, major licensees and other key stakeholders in impacted geographic regions		MoE (Chair IADWG) MoE
Continue to update MoE drought and RFC internet sites to provide up-to-date streamflow and groundwater data and information		MoE (Chair IADWG) MoE
Submit drought assessment reports as necessary to deputy ministers and other senior executives		MoE (Chair IADWG) MoE (ADM Office)
Clearly communicate to agricultural producers the watersheds where the minimum income requirement to maintain farm status for tax assessment purposes will be waived.		MAL
To reduce water on streams for which an order from MOE is being considered, provide the first communication with producers on the process and requirements that are to be followed.		MAL
Prepare information on provincial and federal drought programs that can assist producers to help cope with drought		MAL
Organize workshops for producers in affected areas to provide guidance on water conservation activities, drought assistance programs and processes for application if appropriate		MAL AAFC

Level:	Level 4 (Red)	
Other Actions		
Use consensus building process to confirm priorities for water use reductions in drought affected areas	MoE (Regions)	Local government and water suppliers
Implement next stage watering restrictions to achieve targeted reduction in water use	Local government and water suppliers	
Implement regulatory controls under the <i>Water Act</i> , <i>Fish Protection Act</i> or other statutes as appropriate if voluntary measures are not enough to protect water uses and fish	MoE	
Restrict use by lower priority licensees or those with conditional clauses in their water licences	MoE (Regions)	
Review Emergency Drought Consequence Plans and prepare for implementation; ensure alternative water supplies are identified and available on short notice	Local government and water suppliers	
Provide assistance to communities seeking alternative or temporary water supplies	EMBC	
Ensure water bailiffs are actively regulating and controlling the diversion and use of water from the streams they are appointed to and are accurately communicating drought conditions and watering restrictions and targets	MoE (Regions)	
Provide access to information on stress management resources for agricultural producers as required via internet and other forums	MAL	
Implement drought assistance programs such as dugout filling in regions that are affected	AAFC	
Continue to provide technical assistance and specific measures to water suppliers experiencing problems with system management or promotion of conservation	MCRD	
Monitoring		
Monitor and enforce compliance with restrictions and allocations through bylaws; intensify enforcement efforts as appropriate	Local government and water suppliers	
Continue reporting on status of water supplies and forecasted future scenarios to MoE	Local government and water suppliers	
Monitor and enforce compliance with orders issued under provincial legislation	MoE	
Intensify monitoring of stream conditions and aquatic ecosystems	MoE MoE (Regions) DFO	
Documentation and Preparation for Next Level		
Prepare for emergency response where risk of loss or failure of supply exists	EMBC	Local government and water suppliers
Inform ADM CILM and Minister of Environment of possible loss or failure of supply where the risk exists	MoE (Chair IADWG) MoE (Executive)	
Determine losses due to drought and/or from orders to reduce water use for both livestock and crops	MAL	
Document conservation actions taken to date; maintain registry of groups and individuals contacted; record potential social, environmental and economic impacts	MoE (Chair IADWG) MoE (Regions) MAL	

Appendix 2: Drought Definitions

Meteorological Drought is generally defined by comparing the rainfall in a particular place and at a particular time with the average rainfall for that place. Meteorological drought leads to a depletion of soil moisture and this almost always has an impact on crop production. When we define drought this way, we only consider the reduction in rainfall amounts and do not take into account the effects of the lack of water on water reservoirs, human needs or on agriculture.

Hydrological Drought is associated with the effect of low precipitation on water levels in rivers, reservoirs, lakes and aquifers. Hydrological droughts usually are noticed some time after meteorological droughts. First precipitation decreases and, some time after that, water levels in rivers and lakes drop. Hydrological drought affects uses which depend on ground and surface water levels and stream flows. Changes in water levels affect ecosystems, hydroelectric power generation, and recreational, industrial and urban water use.

Agricultural Drought occurs when there is not enough water available for a particular crop to grow or livestock to thrive at a particular time. This drought does not depend only on the amount of precipitation, but also on the correct use of water. Agricultural drought is typically seen after meteorological drought but before a hydrological drought.

Socio Economic Drought occurs when the demand for an economic good exceeds supply as a result of a weather-related shortfall in water supply. The supply of many economic goods, such as water, forage, food grains, fish, and hydroelectric power, depends on weather. Severity and impact are affected by water demand, the extent of water use efficiency measures, and the ability to bring new supplies on-line.

These definitions were agreed to by a working group of staff from British Columbia, Alberta, Saskatchewan and Manitoba during the Western Water Stewardship Council Technical Workshop on Drought Preparedness held in Calgary on 4 May 2009. They are adapted from the following sources:

Moneo, Marta; Iglesias, Ana (2004). Types of Drought, Universidad Politécnica de Madrid, España, accessed at <http://www.atmosphere.mpg.de/enid/26b.html>, accessed on 29 January 2010.

National Drought Mitigation Center (2006). What is Drought? Understanding and Defining Drought, accessed at <http://drought.unl.edu/whatis/concept.htm#conceptual>, accessed on 29 January 2010.

Appendix 3: Key Drought Legislation

Legislation	Primary Administering Agency	General Scope
<i>Water Act</i>	Ministry of Environment	<p>Provides for the allocation and management of surface water by authorizing issuance of water licences and approvals, creation of reserves, development of water management plans, and establishment of water user communities.</p> <p>The Act also sets out protective measures for wells and groundwater, and identifies offences and penalties.</p>
<i>Fish Protection Act</i>	Ministry of Environment	<p>Protects fish and fish habitat by prohibiting bank-to-bank dams on protected rivers and authorizing designation of “sensitive streams” for fish sustainability. It also provides authorities for provincial directives for streamside protection.</p> <p>Section 9 of the Act allows the Minister of Environment to temporary order regulation or reduction of the diversion, rate of diversion or time of diversion of water from a stream in order to ensure the survival of a fish population, provided that consideration has been given to the needs of agricultural users.</p>
<i>Fisheries Act</i>	Department of Fisheries and Oceans Canada	Protection of fish and fish habitat
<i>Drinking Water Protection Act</i>	Ministry of Healthy Living and Sport	Requires that water supply systems must provide potable water and must have construction and operating permits. It also establishes qualification standards for operators; and requirements for emergency response, water monitoring, water source and system assessments, a process for preparing a drinking water protection plan, and other protective measures for drinking water supplies.
<i>Emergency Program Act</i>	Ministry of Public Safety and Solicitor General (PSSG)	<p>Provides enabling legislation that authorizes the PSSG Minister to declare and designate any area of the province a disaster area (i.e. State of Emergency), and during an emergency, to obtain reserve powers.</p> <p>The Act also enables local authorities such as a mayor or council to declare a State of Local Emergency, which provides similar, wide-ranging emergency powers.</p>
<i>Environmental Management Act</i>	Ministry of Environment	Regulates industrial and municipal waste discharge, pollution, hazardous waste, and contaminated site remediation. This Act also requires preparation of environmental plans for flood control, drainage, soil conservation, water resource management, waste management, and air quality management.

Legislation	Primary Provincial Administering Agency	General Scope
<i>Local Government Act and Community Charter</i>	Ministry of Community and Rural Development	Sets out the corporate authority of various types of local governments (municipalities, regional districts, improvement districts, etc.). From the perspective of water management, of greatest significance are powers and responsibilities relating to land use, growth, infrastructure (e.g. storm water management), works, and similar matters.
<i>Water Utility Act</i>	Ministry of Environment	Provides for regulating privately operated water systems servicing five or more persons or a corporation. Operators are subject to the same duties, responsibilities and restraints that are imposed on a public utility under the <i>Utilities Commission Act</i> .

The legal framework for managing water in British Columbia is not limited to just these statutes. Many other provincial, federal and local government laws are also relevant. A summary of provincial and federal water legislation can be found at: www.env.gov.bc.ca/wsd/water_rights/overview_legislation/index.html.

Appendix 4: Provincial and Federal Agency Drought Responsibilities

Agency	Drought Management Responsibilities
Provincial Agencies	
Ministry of Environment	<ul style="list-style-type: none"> ◆ Lead provincial agency for drought coordination and response ◆ Administers the <i>Water Act</i> and the <i>Fish Protection Act and Environmental Management Act</i> ◆ Operates the River Forecast Centre; collects and interprets snow, meteorological and streamflow data to provide warnings and forecasts of stream and lake runoff conditions ◆ Monitors ambient water quality and groundwater levels ◆ Protects and restores fish habitat and aquatic ecosystems ◆ Communicates directly with licensees under the <i>Water Act</i> about actions commenced under this plan
Ministry of Agriculture and Lands	<ul style="list-style-type: none"> ◆ Supports agricultural industry water requirements used in the production of food and other agricultural products ◆ Communicates with the broad agricultural community about actions commenced under this plan ◆ Collects and disseminates information on irrigation, crop, soil and livestock management during times of drought
Ministry of Community and Rural Development	<ul style="list-style-type: none"> ◆ Oversees local government activities under the <i>Local Government Act</i> ◆ Provides water conservation resources and advice to local government water purveyors ◆ Communicates with local government about actions commenced under this plan
Ministry of Forests and Range	<ul style="list-style-type: none"> ◆ Manages and protects water as a forest resource under the <i>Forest and Range Practices Act</i> ◆ Lead agency for managing wildfire threats
Ministry of Healthy Living and Sport	<ul style="list-style-type: none"> ◆ Protects drinking water and ensure that potable supplies are protected under the <i>Drinking Water Protection Act</i>
Ministry of Public Safety and the Solicitor General (Provincial Emergency Program), Emergency Management B.C.	<ul style="list-style-type: none"> ◆ Coordinates response to water related emergencies such as loss or near-loss and failure of supply
Federal Agencies	
Agriculture and Agri-Food Canada	<ul style="list-style-type: none"> ◆ Delivers the federal Drought Watch program to provide timely information of the impacts of climatic variability on water supply and agriculture ◆ Promotes agricultural practices that reduce drought vulnerability and improve management during a drought
Environment Canada (Water Survey of Canada) (supporting agency)	<ul style="list-style-type: none"> ◆ Responsible for the collection, interpretation and dissemination of standardized water resource information ◆ Operates hydrometric, climate and water quality networks in partnership with the B.C. Ministry of Environment
Fisheries and Oceans Canada	<ul style="list-style-type: none"> ◆ Administers the federal <i>Fisheries Act</i>, which protects fish and fish habitats
Indian and Northern Affairs Canada (supporting drought efforts)	<ul style="list-style-type: none"> ◆ supports Aboriginal people (First Nations, Inuit and Métis) and Northerners in their efforts to develop healthier, more sustainable communities

Appendix 5: Chronology of Key Government Actions in a Model Drought Year

Key Actions	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monitoring												
Complete snow surveys and assess Basin Snow Indices												
Assess Seasonal Volume Runoff Forecasts												
Assess 30 Day Percent of Average Precipitation conditions												
Assess 7-Day Average Streamflow conditions												
Augment streamflow and aquifer level monitoring as required												
Monitor community and licensee water use												
Coordination												
Convene Inter-Agency Drought Working Group (1 st meeting)												
Continue Inter-Agency Drought Working Group meetings												
Convene Local Drought Working Group meetings												
Elevate drought level ratings as appropriate												
Request water licensees voluntarily conserve and share water												
Retract drought level ratings												
Conduct post drought workshop												
Communication												
Issue first province-wide news release for season												
Issue monthly info bulletins on water supply conditions												
Designate provincial and local drought spokespeople												
Recommend early activities to agricultural producers												
Issue local media advisories as required												
Issue targeted media advertizing as required												
Escalate conservation messaging as appropriate												
Contact high volume users directly via mail as required												
Increase frequency and intensity of communication as required												
Other Action												
Local authorities introduce watering restrictions as required												
Local authorities update and amend restrictions as appropriate												
Undertake regulatory actions as appropriate												
Undertake enforcement actions as appropriate												
Prepare emergency response where loss or failure of supply risk exists												

Appendix 6: Drought Response Communications Summary Table

	Province Wide Communications		Region Wide Communications		Targeted Regional Communications*		Direct Communication with Water Licensees	
	Task	Who	Task	Who	Task	Who	Task	Who
Level 2 (Yellow)	Issue province-wide news release	PAB	Issue targeted news releases in impacted geographic regions	PAB	Provide updates via email to key stakeholder groups and major licensees	MoE	Use direct and indirect communications to request water licensees voluntarily conserve & share water	MoE, DFO
	Regularly issue updated online water supply and snow bulletins	MoE	Issue Low Stream Flow Advisories in impacted geographic regions	MoE	Attend public meetings	MoE, MAL, DFO	Where appropriate, advise agricultural producers to take early actions	MAL
			Designate local media spokesperson(s) for local level issues	PAB				
Level 3 (Orange)	Issue updated province-wide news release	PAB	Intensify local communication efforts as appropriate based on current streamflow conditions	PAB MoE	Intensify frequency of updates as appropriate via email to key stakeholder groups and major licensees	MoE	Advise high volume water licensees directly via mail; request voluntary conservation	MoE
	Potentially hold media news conference to announce activation of additional drought measures and to provide updated information	PAB MoE	Issue updated targeted news releases in impacted geographic regions	PAB	Commence utilization of additional communication channels (e.g. print, social media, associations, etc.)	PAB MoE	Use direct and indirect communications to request water licensees voluntarily conserve & share water	MoE, DFO
	Continue to regularly issue updated online water supply and snow bulletins	MoE			Attend public meetings	MoE, MAL, DFO	Where appropriate, work with BCAC and AAFC to advise agricultural producers to take early actions	MAL

Level 4 (Red)	Task	Who	Task	Who	Task	Who	Task	Who
	Increase frequency and intensity of province wide communication through media, advertizing, internet, email updates and other forums	PAB	Increase frequency and intensity of targeted local communication through media, advertizing, internet, email updates and other forums	PAB MoE	Continue to issue frequent updates as appropriate via email to key stakeholder groups and major licensees	MoE	Advise high volume water licensees directly of conditions via mail or other direct means;	MoE
	Continue to regularly issue updated online water supply and snow bulletins	MoE					Continue to request voluntary conservation; undertake regulatory action as required	
							Contact producers that may be required to reduce water use	MAL

* Targeted regional communications includes direct communication with community groups, user groups, local governments, First Nations and others as well as participation in community events, response to local media inquiries and other local level activities.

Appendix 7: Additional Resources

All emergency situations that affect the health and safety of the public should be reported to the Provincial Emergency Program at 1-800-663-3456.

Provincial Government Resources

Water Stewardship Division Drought Information

B.C. Ministry of Environment

http://www.env.gov.bc.ca/wsd/public_safety/drought_info/

Links to low provincial government drought information including streamflow advisories, handbooks and fact sheets, River Forecast Centre resources and more.

Drought Strategies

B.C. Ministry of Agriculture and Land

<http://www.agf.gov.bc.ca/emergency/Drought/>

Extensive information on irrigation, crop, soil, livestock, pasture and range management in drought as well as links to resources on feed and pasture availability and financial programs.

Provincial Emergency Program, Emergency Management B.C.

B.C. Ministry of Public Safety and Solicitor General

http://www.pep.bc.ca/Emerg_Mgmt_BC/Emerg_Mgmt_BC.html

This site provides an overview of the Provincial Emergency Program and its work to provide training and support before, during and after emergencies.

The River Forecast Centre, Water Stewardship Division

B.C. Ministry of Environment

<http://www.env.gov.bc.ca/rfc/>

The River Forecast Centre (RFC) collects and interprets snow, meteorological and streamflow data to provide warnings and forecasts of stream and lake runoff conditions around the province.

Dealing With Drought: A Handbook for Water Suppliers in British Columbia

B.C. Ministry of Environment, Water Stewardship Division

http://www.env.gov.bc.ca/wsd/public_safety/drought_info/cabinet/drought_handbook2009V2.pdf

Updated in 2009, this document provides local government water suppliers with tools including a drought planning template, an emergency drought consequences template, example bylaws, and links to other resources.

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Fire Danger Rating Reports
B.C. Ministry of Forests and Range
http://bcwildfire.ca/Weather/Maps/danger_rating.htm

Maps on fire danger ratings across B.C., produced annually during fire season from 15 April to 15 October.

Federal Government Resources

Drought Watch
Agriculture and Agri-Food Canada
http://www.agr.gc.ca/pfra/drought/index_e.htm

This is Agriculture and Agri-Food Canada's web hub for national and regional information targeted at the agricultural sector. It links to information on current conditions and access to federal assistance programs.

The Weather Office
Environment Canada
http://www.weatheroffice.gc.ca/forecast/canada/index_e.html?id=BC

Current and forecast weather from Environment Canada.

Technical Resources

Irrigation Industry Association of BC (IIABC): www.irrigationbc.com
The IIABC web site provides access to the tools and irrigation manuals that can assist in improving the operation of irrigation systems.

- Irrigation Management Guide
- BC Sprinkler Irrigation Manual
- BC Trickle Irrigation Manual

Irrigation Scheduling Calculators

BC Agriculture Council
The BC Agriculture Council has produced the Environmental Farm Planning documents that can provide information on conducting an irrigation system assessment. These documents assist in evaluating irrigation system operation.

- Environmental Farm Plan Reference Guide
- Irrigation Assessment Guide

BC Water and Waste Association
The Waterbucket website provides additional information on agriculture and drought.
www.Waterbucket.ca

Note the MAL website also has reference information on how to read your water licence, peak flows for agriculture, etc. This could be listed here or additional explanation can be made to this under MAL above. Does MOE have reference to this kind of information as well? If so it could be reference there.

Other Resources

Drought Research Initiative (DRI)

<http://www.drinetwork.ca/>

The Drought Research Initiative is a five-year coordinated research program that brings together a network of many university and federal/provincial government researchers with expertise encompassing the atmospheric, hydrologic, land surface, and predictive aspects of droughts. While focused on the Canadian prairies, the DRI website provides a wealth of resources, data and current research on drought impacts and planning.

National Drought Mitigation Centre (NDMC)

University of Nebraska - Lincoln.

<http://drought.unl.edu/index.htm>

The NDMC is dedicated to helping “people and institutions develop and implement measures to reduce societal vulnerability to drought, stressing preparedness and risk management rather than crisis management.” While focused on the United States, the NDMC website has a wealth of information on drought planning, monitoring, impacts and mitigation.

.U.S. Drought Portal

National Integrated Drought Information System

<http://www.drought.gov>

The U.S. National Oceanic and Atmospheric Administration leads implementation of the National Integrated Drought Information System (NIDIS). The U.S. Drought Portal is part of this interactive system to provide early warning about emerging and anticipated droughts, assimilate and quality control data, and provide information about risk and impact to different agencies and stakeholders.

British Columbia Drought Response Plan



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Prepared by:

econnics
eco-efficiency specialists

econnics - eco-efficiency specialists
www.econnics.com
kirk@econnics.com
+1 250 588 6851